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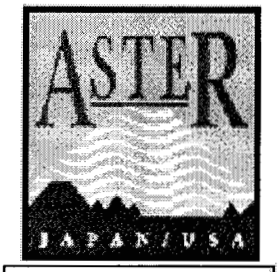

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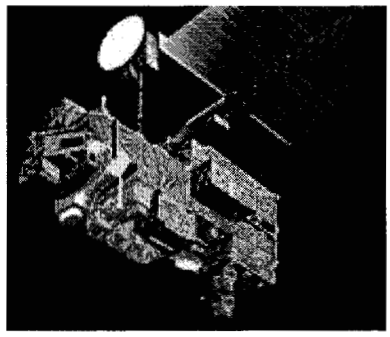


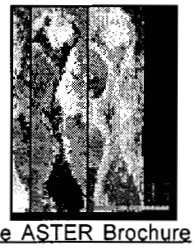
ASTER (Advanced Spaceborne Thermal Emission and Reflection Radiometer) is an imaging instrument that is flying on Terra, a satellite launched in December 1999 as part of NASA's Earth Observing System (EOS). ASTER will be used to obtain detailed maps of land surface temperature, emissivity, reflectance and elevation. The EOS platforms are part of NASA's Earth Science Enterprise, whose goal is to obtain a better understanding of the interactions between the biosphere, hydrosphere, lithosphere and atmosphere.

ASTER is the only high spatial resolution instrument on the Terra platform. It will be used with MODIS, MOPITT, MISR and CERES which monitor the Earth at moderate to coarse spatial resolutions. ASTER's ability to serve as a 'zoom' lens for the other instruments will be particularly important for change detection, calibration/validation and land surface studies.

The ASTER instrument was built in Japan for the Ministry of International Trade and Industry. A Joint US/Japan Science Team is responsible for instrument design, calibration, and validation.

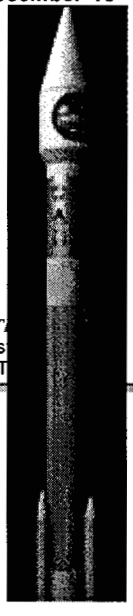
The primary objective for the ASTER mission is to:

- Obtain high spatial resolution global, regional and local images of the Earth in 14 colors (spectral bands.)



Download The ASTER Brochure (*pdf 5310k*)

December 18



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Questions? Comments? Contact: *Howard L Tan or Simon J Hook*

Last Changed: *May 11, 2000*

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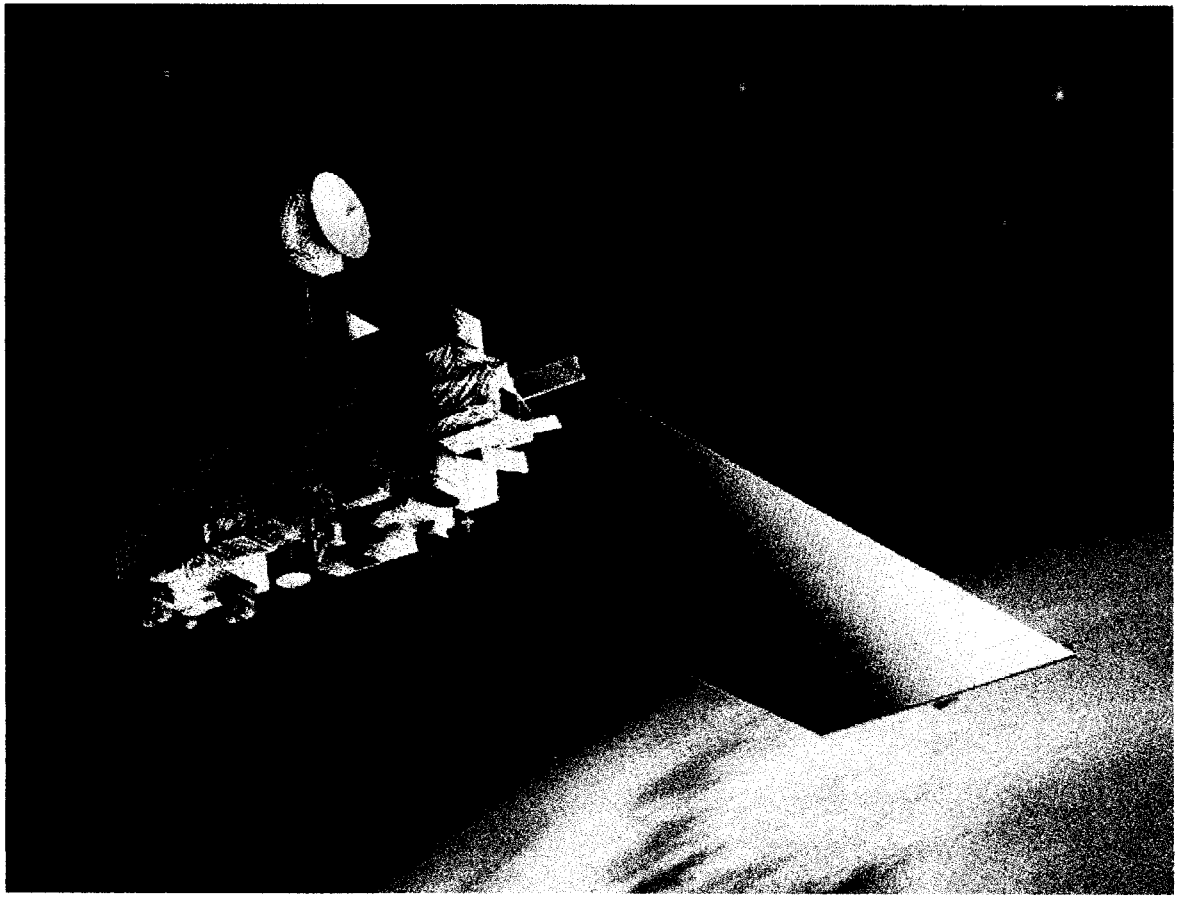
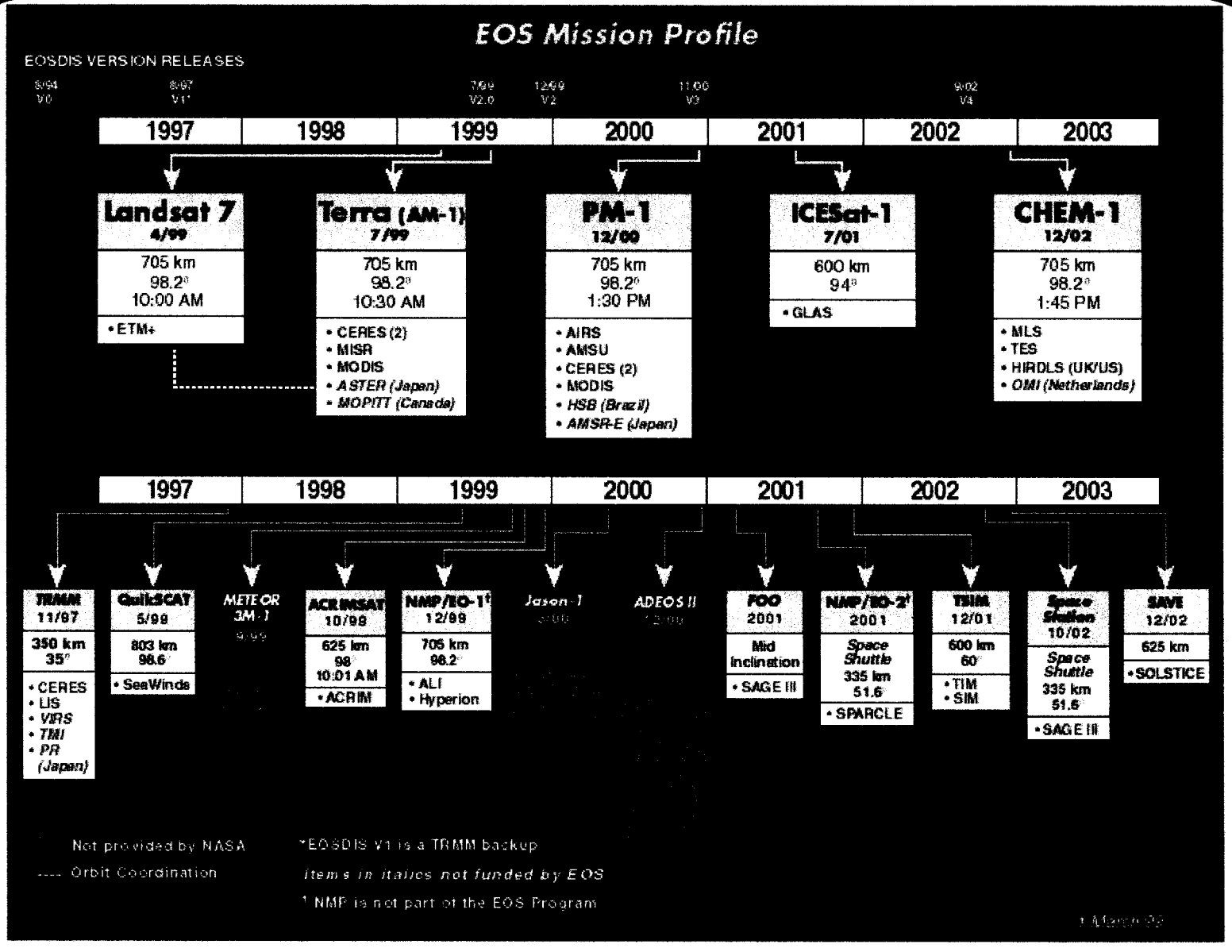
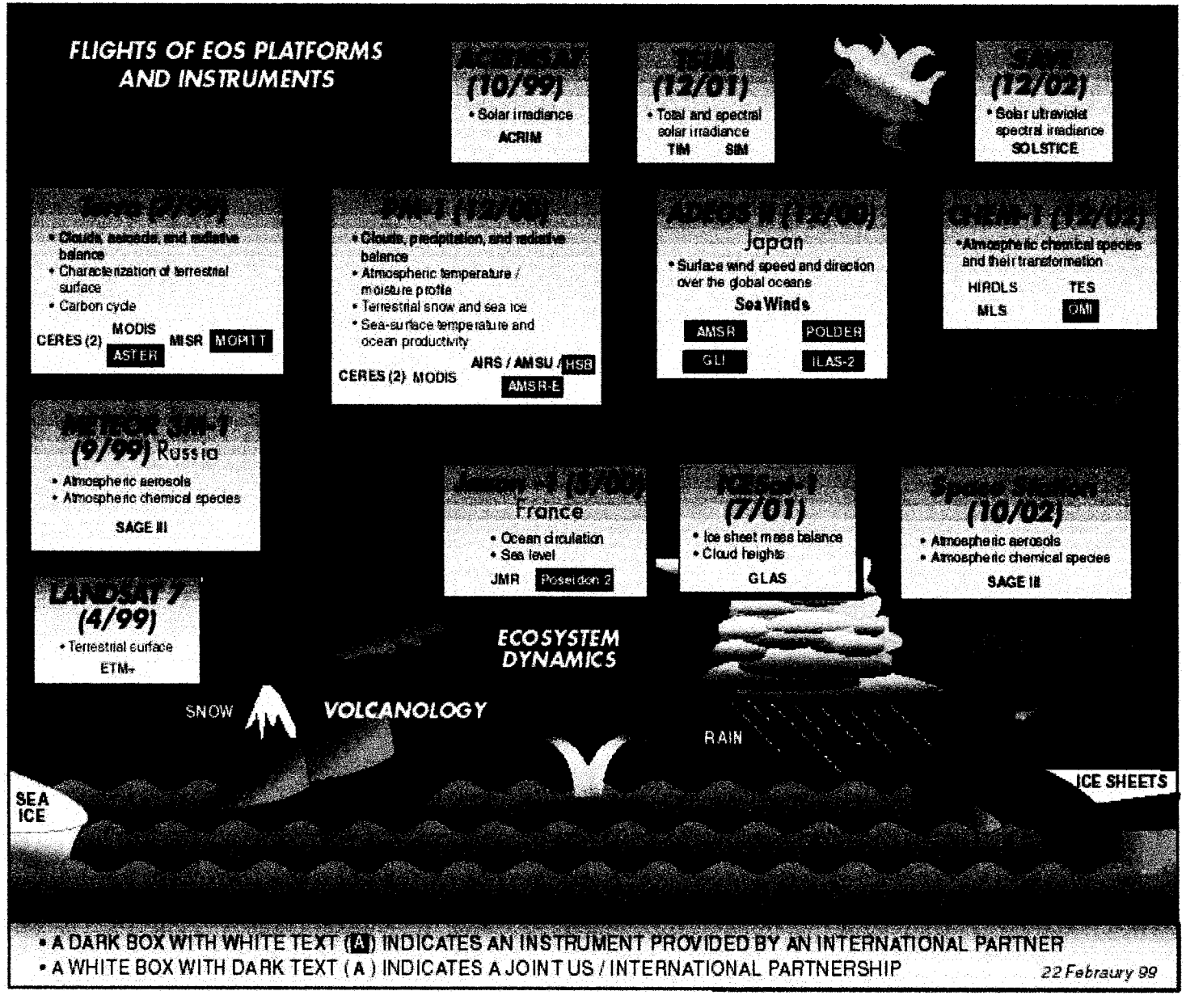
Advanced Spaceborne Thermal Emission and Reflection Radiometer




EOS Mission Profile
EOSDIS VERSION RELEASES
8/94 V0
8/97 V1*
7/99 V2.0
12/99 V2
11/00 V3
9/02 V4
1997
1998
1999
2000
2001
2002
2003
Landsat 7
4/99
705 km
98.2°
10:00 AM
• ETM+
Terra (AM-1)
7/99
705 km
98.2°
10:30 AM
• CERES (2)
• MISR
• MODIS
• ASTER (Japan)
• MOPITT (Canada)
PM-1
12/00
705 km
98.2°
1:30 PM
• AIRS
• AMSU
• CERES (2)
• MODIS
• HSB (Brazil)
• AMSR-E (Japan)
ICESat-1
7/01
600 km
94°
• GLAS
CHEM-1
12/02
705 km
98.2°
1:45 PM
• MLS
• TES
• HIRDLS (UK/US)
• OMI (Netherlands)
1997
1998
1999
2000
2001
2002
2003
TRMM
11/97
350 km
35°
• CERES
• LIS
• VIRS
• TMI
• PR
(Japan)
QuikSCAT
5/99
803 km
98.6°
• SeaWinds
METEOR 3M-1
9/99
ACRIMSAT
10/99
625 km
98°
10:01 AM
• ACRIM
NMP/EO-1[1]
12/99
705 km
98.2°
• ALI
• Hyperion
Jason-1
12/00
ADEOS II
12/00
FOO
2001
Mid Inclination
• SAGE III
NMP/EO-2[1]
2001
Space Shuttle
335 km
51.6
• SPARCLE
TSIM
12/01
600 km
60°
• TIM
• SIM
Space Station
10/02
Space Shuttle
335 km
51.6
• SAGE III
SAVE
12/02
625 km
• SOLSTICE
Not provided by NASA
---- Orbit Coordination
*EOSDIS V1 is a TRMM backup
Items in italics not funded by EOS
[1] NMP is not part of the EOS Program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• Solar irradiance
ACRIM
(12/01)
• Total and spectral solar irradiance
TIM SIM
(12/02)
• Solar ultraviolet spectral irradiance
SOLSTICE
• Clouds, aerosols, and radiative balance
• Characterization of terrestrial surface
• Carbon cycle
CERES (2) MODIS MISR MOPITT ASTER
• Clouds, precipitation, and radiative balance
• Atmospheric temperature / moisture profile
• Terrestrial snow and sea ice
• Sea-surface temperature and ocean productivity
CERES (2) MODIS AIRS / AMSU / HSB AMSR-E
Japan
• Surface wind speed and direction over the global oceans
SeaWinds
AMSR POLDER GLI ILAS-2
• Atmospheric chemical species and their transformation
HIRDLS TES MLS OMI
(9/99) Russia
• Atmospheric aerosols
• Atmospheric chemical species
SAGE III
France
• Ocean circulation
• Sea level
JMR Poseidon 2
(7/01)
• Ice sheet mass balance
• Cloud heights
GLAS
(10/02)
• Atmospheric aerosols
• Atmospheric chemical species
SAGE III
(4/99)
• Terrestrial surface
ETM+
ECOSYSTEM DYNAMICS
SNOW
VOLCANOLOGY
RAIN
SEA ICE
ICE SHEETS
• A DARK BOX WITH WHITE TEXT (A) INDICATES AN INSTRUMENT PROVIDED BY AN INTERNATIONAL PARTNER
• A WHITE BOX WITH DARK TEXT (A) INDICATES A JOINT US / INTERNATIONAL PARTNERSHIP
22 Febraury 99

Terra Instruments

ASTER - Advanced Spaceborne Thermal Emission and Reflection Radiometer

CERES - Clouds and Earth's Radiant Energy System

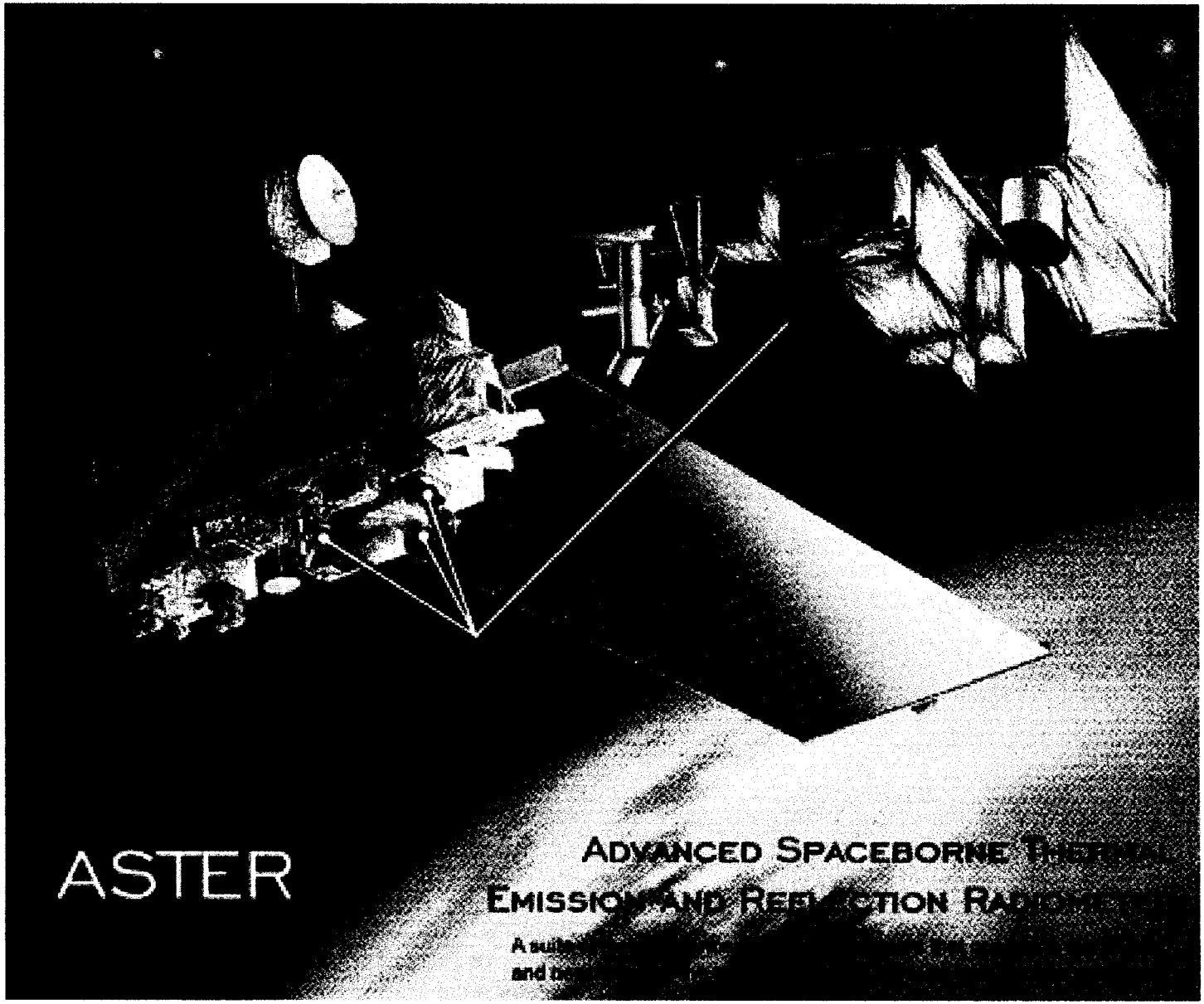
MISR - Multi-angle Imaging Spectro Radiometer

MODIS - Moderate Resolution Imaging Spectro-Radiometer

MOPITT - Measurements of Pollution in the Troposphere

Terra Orbit Parameters

Orbit	Sun Synchronous Descending Node
Time of Day	10:30 am
Altitude	705 km
Inclination	98.2°
Repeat Cycle	16 days

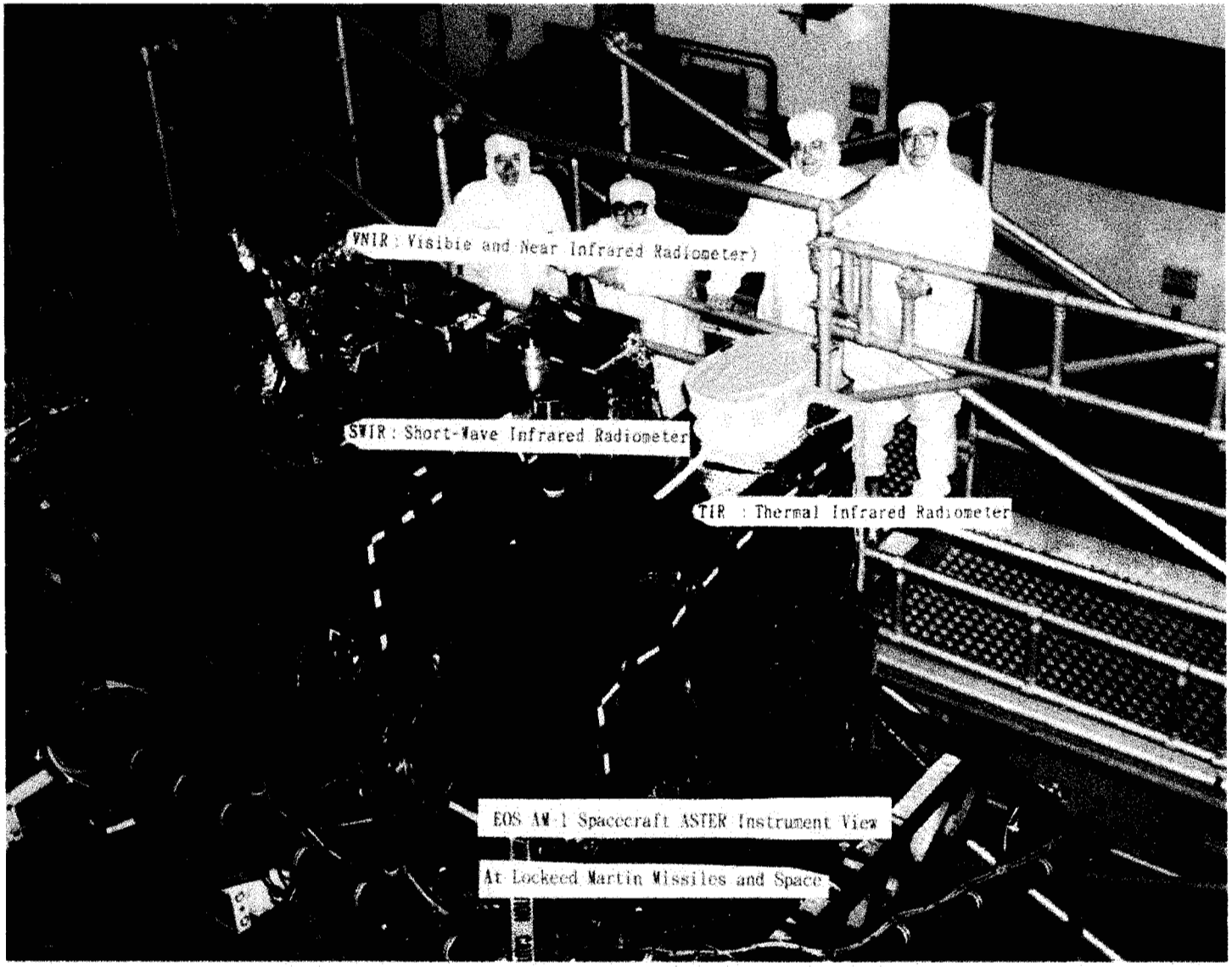

ASTER
ADVANCED SPACEBORNE
EMISSION AND

ASTER Instrument Overview

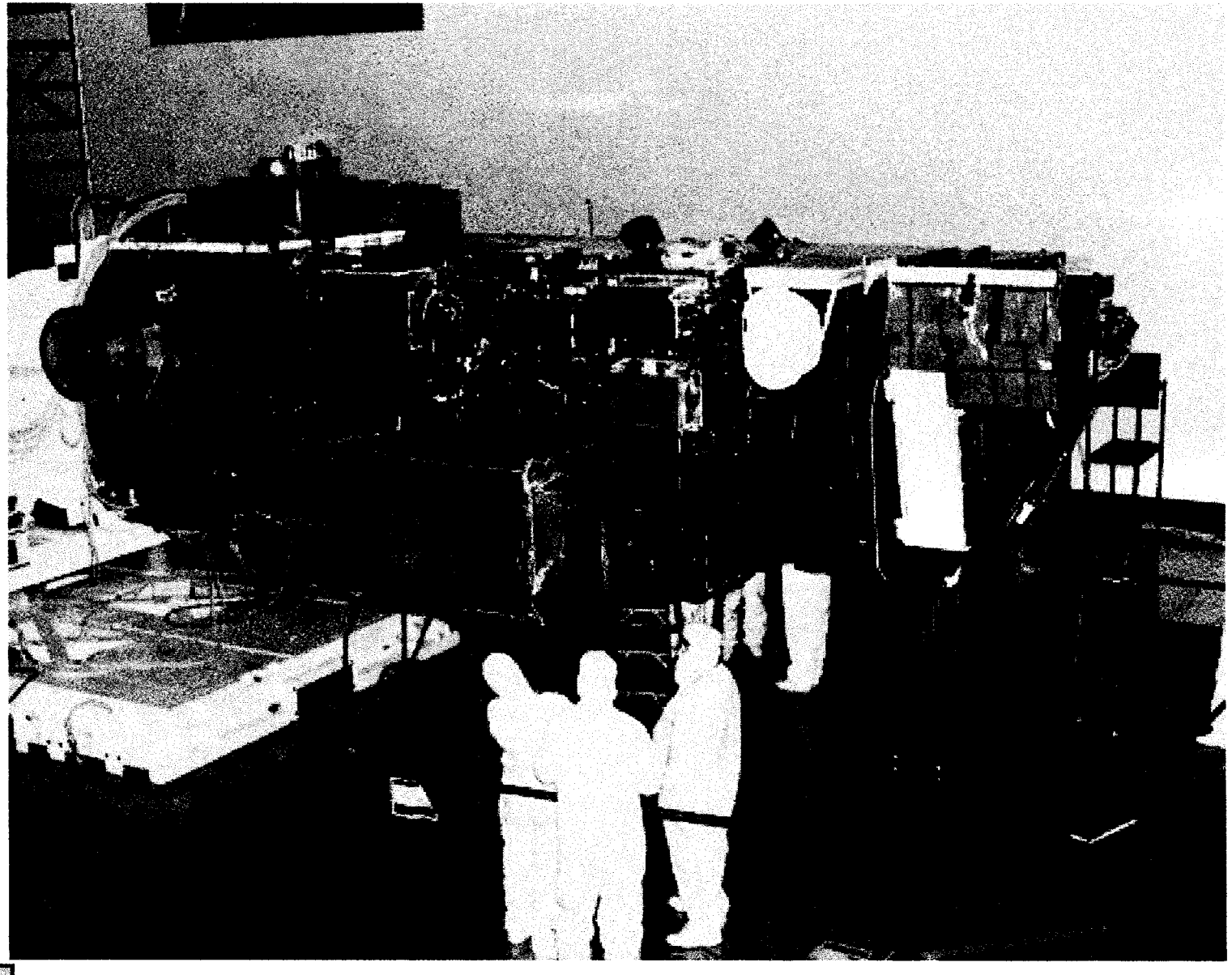
- ASTER is an international effort:
  - Japanese government is providing the instrument under MITI (Ministry of International Trade and Industry) and is responsible for Level 1 data processing
  - Will fly on NASA's Terra platform
  - Science team consists of Japanese, American, Australian, and French scientists

ASTER Instrument

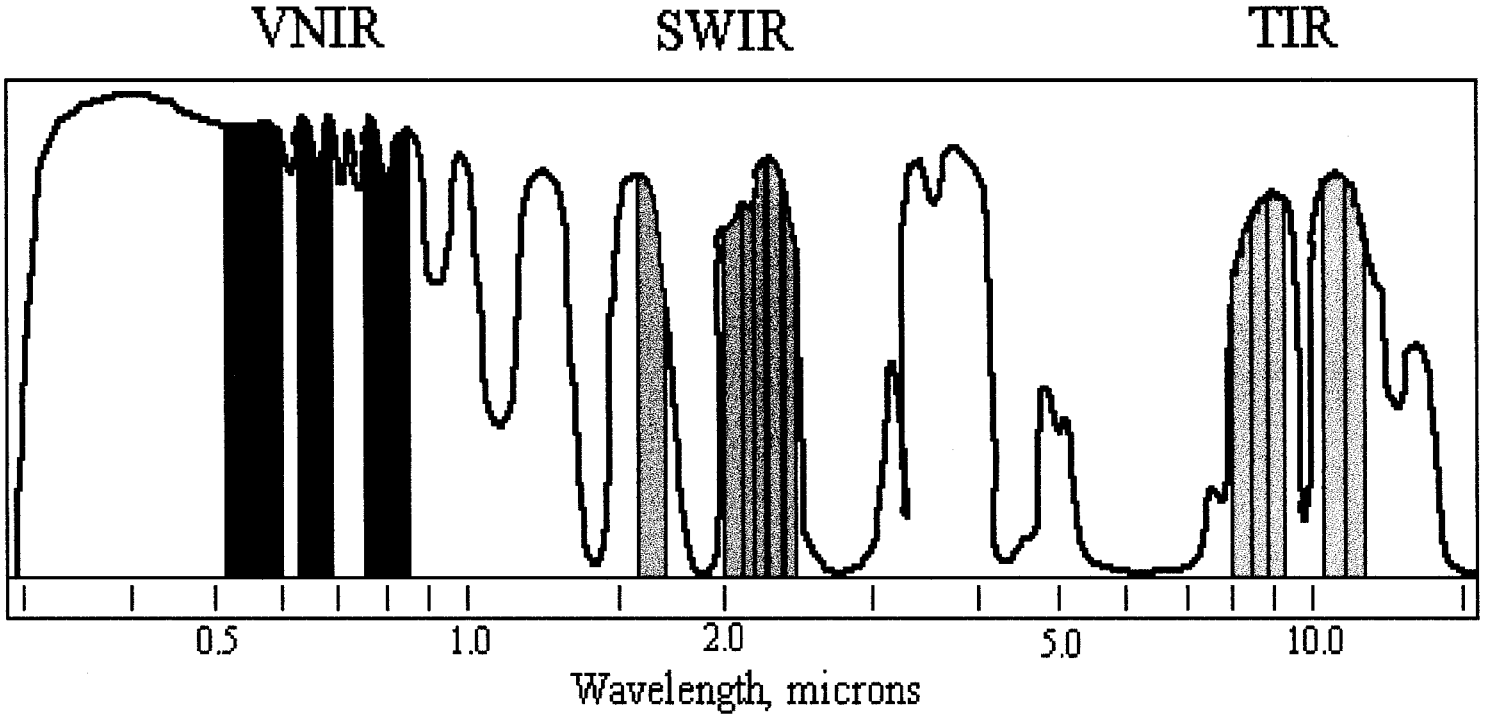
- *A*dvanced *S*paceborne *T*hermal *E*mission and *R*eflection Radiometer
- 1999 launch on Terra
- Joint Japan/US effort
- 15m visible, 30 m swir, 90 m tir
- 60 km swath
- < 16 day repeat cycle



ASTER Instrument on EOS-AM1 Platform



ASTER Bands



ASTER Science Team

Consists primarily of Japanese and US members

Conducts scientific research related to EOS goals using ASTER data

Provides scientific guidance to hardware builders:

- functional requirements
- design issues
- calibration
- modes of operations

ASTER Science Team

Selects algorithms for higher level standard products

Produces software for standard products

Conducts joint calibration and validation exercises

Conducts mission operations, scheduling, and mission analysis

ASTER Instrument Operations

- ASTER has a limited duty cycle which implies decisions regarding usage must be made
- Observation choices include targets, telescopes, pointing angles, gains, day or night observations
- Telescopes capable of independent observations and maximum observation time in any given orbit is 16 minutes
- Maximum acquisitions per day

Acquired	~750
Processed	~330

ASTER Instrument Operations

- Number of pointing changes over life of mission limited to 10,000 -- approximately 1 per 2.5 orbits for VNIR and SWIR
- Pointing changes to be made during nighttime part of orbit
- These limitations allow a maximum of 1.7 million scenes over the life of the mission

Science Prioritization of ASTER data acquisition

- NASA HQ, GSFC, and MITI have charged the Science Team with developing the strategy for prioritization ASTER data acquisition
- Must be consistent with EOS goals, the Long Term Science Plan, and the NASA-MITI MOU
- Must be approved by EOS Project Scientist

Global Data Set

- A one-time acquisition
  - All land surfaces, including stereo
  - Maximize high sun
  - "Optimal" gain
- Consists of pointers to processed and archived granules which:
  - Meet the minimum requirements for data quality
  - Are the "best" acquired satisfying global data set criteria
- Science Team has prioritized areas for acquisition (high, medium and low)

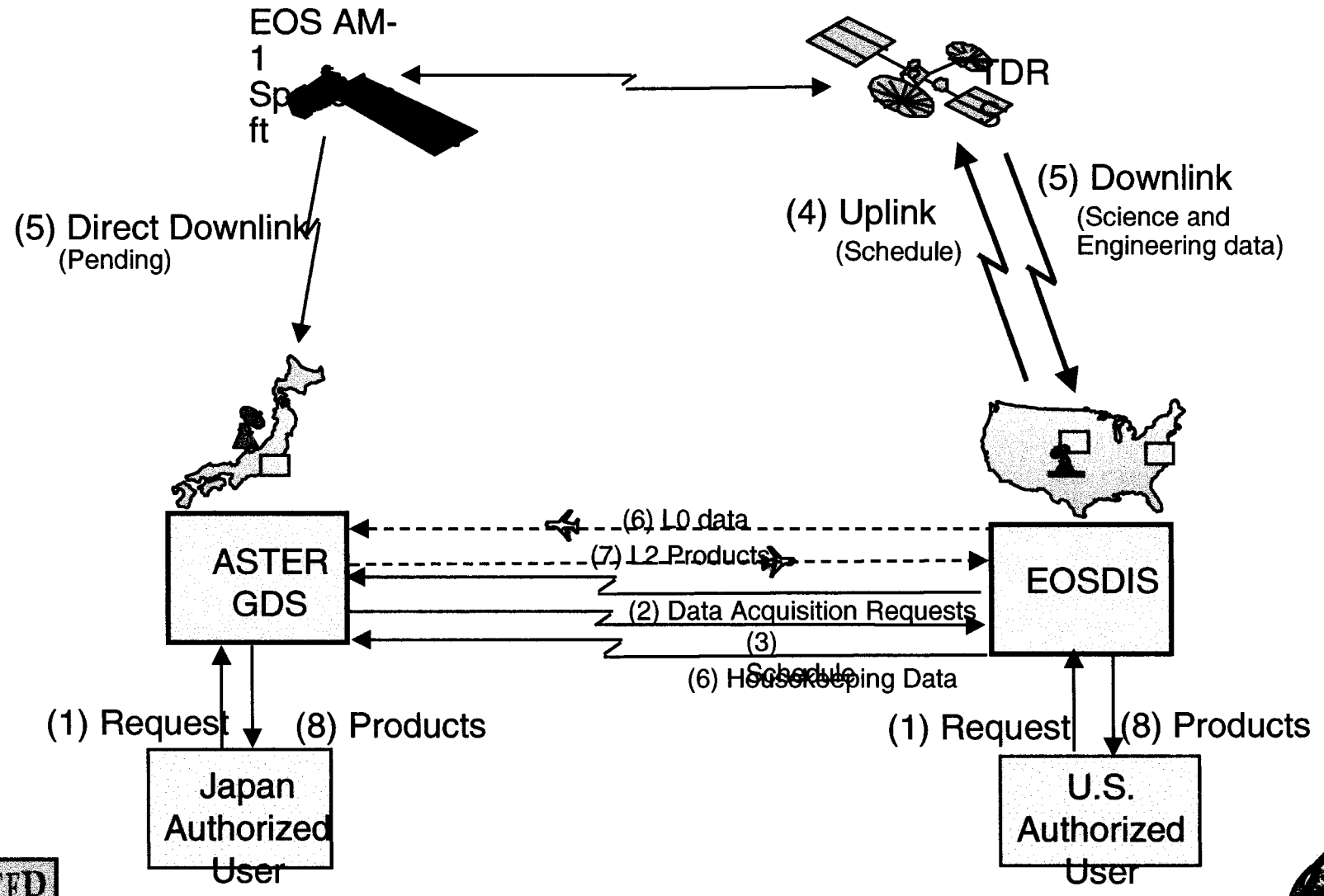
Regional Data Sets

- Focus on specific physiographic regions of Earth, usually requiring multi-temporal coverage
- Acquisitions are intended to satisfy multiple users, as opposed to specific requirements of individual investigator or small team
- Defined by the ASTER Science Team in consultation with other users (e.g., EOS interdisciplinary scientists)
- Science team provides prioritization (relative to other regional data sets) on a case-by-case basis

Targeted Observations

- Targeted observations are made in response to Data Acquisition Requests (DARs) from individual investigators or small groups for specific research purposes
- Japanese Instrument Control Center (ICC) does prioritization of DAR based on guidelines provided by Science Team
- Targeted observation may also be used to satisfy the global data set or regional data set acquisition goals, where appropriate

End-to-End Data System Architecture

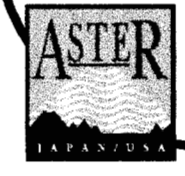


How Will I Get ASTER Data

- Browse the archive: use the EOS Data Gateway (EDG) to find what data have already been acquired. Order data products desired: http://harp.gsfc.nasa.gov/~imswww/pub/imswelcome/
- Submit a Data Acquisition Request: First become an authorized user; then request satellite obtain your particular data

Scientists Authorized to Submit DARs

- ASTER Science Team
- Other EOS Instrument Team members
- EOS Interdisciplinary Science Teams
- Other scientists “registered” by Japan



Authorizing Non-EOS Users to Request ASTER Acquisition

U.S. PROCESS FOR AUTHORIZING NON-EOS ASTER USERS:

- Interested ASTER user sends proposal electronically
  - Proposal forms, and ASTER information, will be available on-line
  - Proposal (1-2 pages long) can be submitted electronically at any time
    - Each proposal includes estimate of number of ASTER scenes
    - Proposals evaluated by committee: ASTER Team Members, NASA HQ, external scientists
    - Most proposals evaluated within few weeks
  - Notice of acceptance or rejection sent by e-mail
- Once authorized, new user can request that ASTER acquire new data
  - U.S. users submit ASTER DARs via DAR Clients, provided by ECS

SPECIFIC NUMBER OF ASTER SCENES ALLOCATED TO EACH SUCCESSFUL PROPOSAL

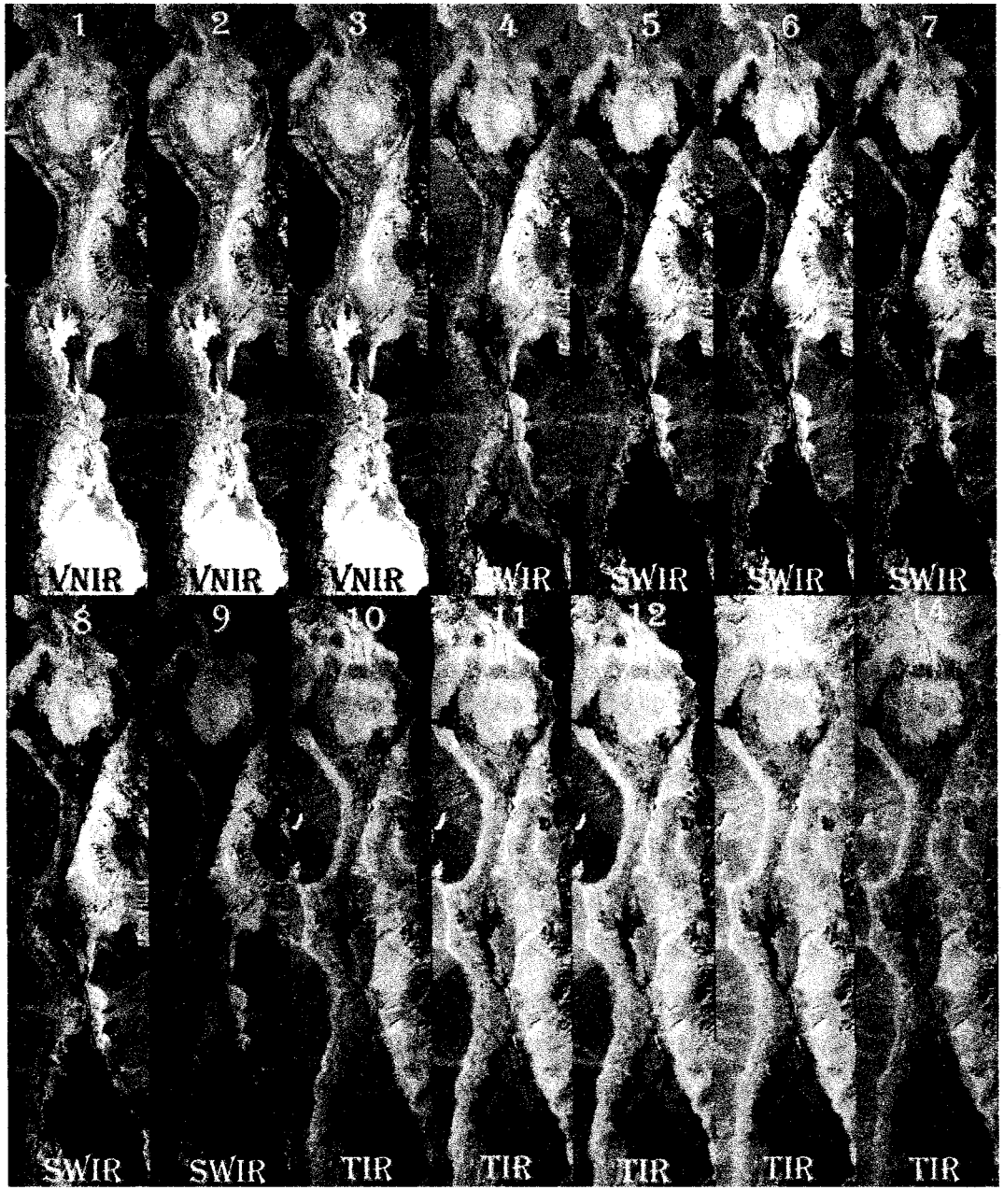
- Scenes are allocated based on estimated requirements (included in proposal)

ASTER Standard Data Products

Level-1 Data
Decorrelation Stretch: VNIR, SWIR, TIR
Brightness Temperature
Surface Reflectance/Radiance: VNIR & SWIR
Surface Reflectance/Radiance: TIR
Surface Emissivity
Surface Kinetic Temperature
Digital Elevation Model

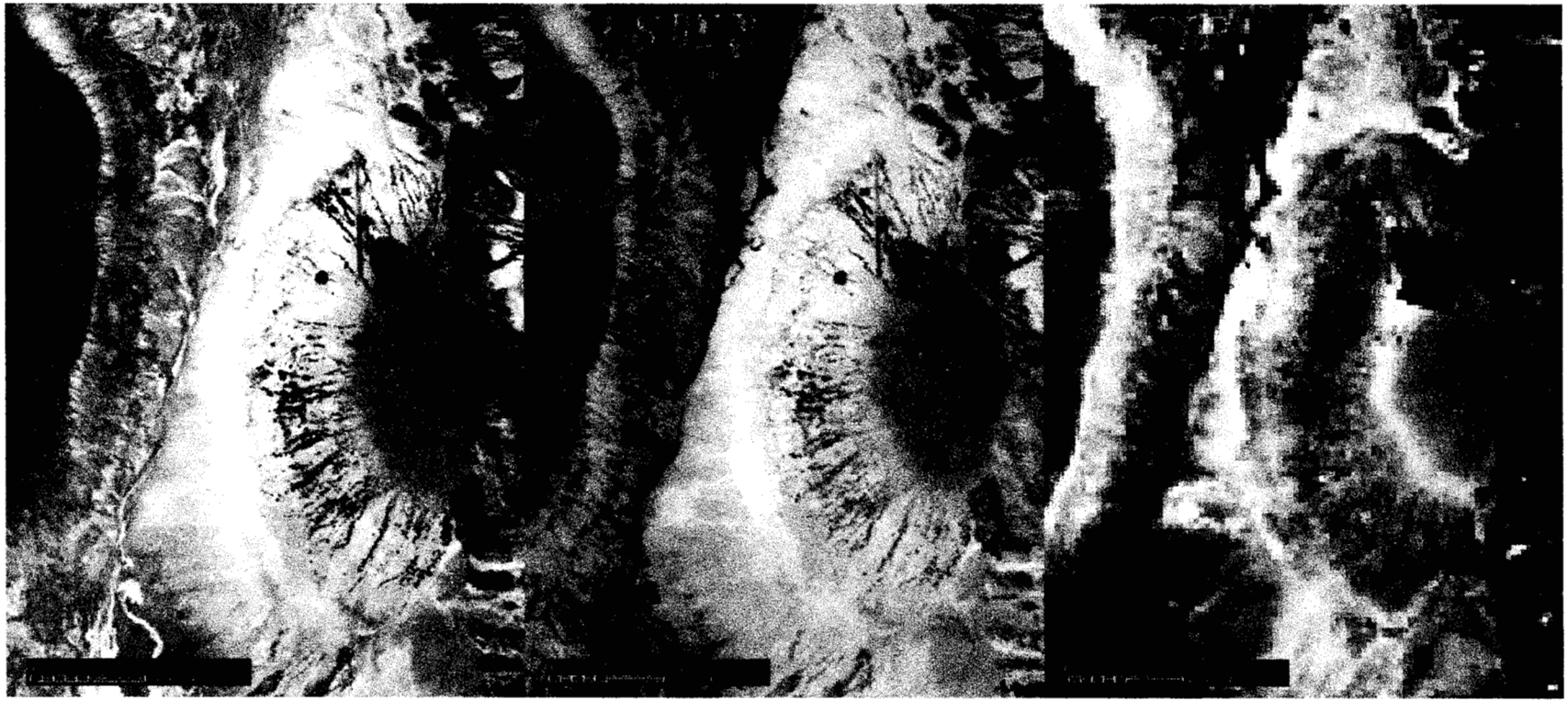
Death Valley

14 radiance channels



Death Valley

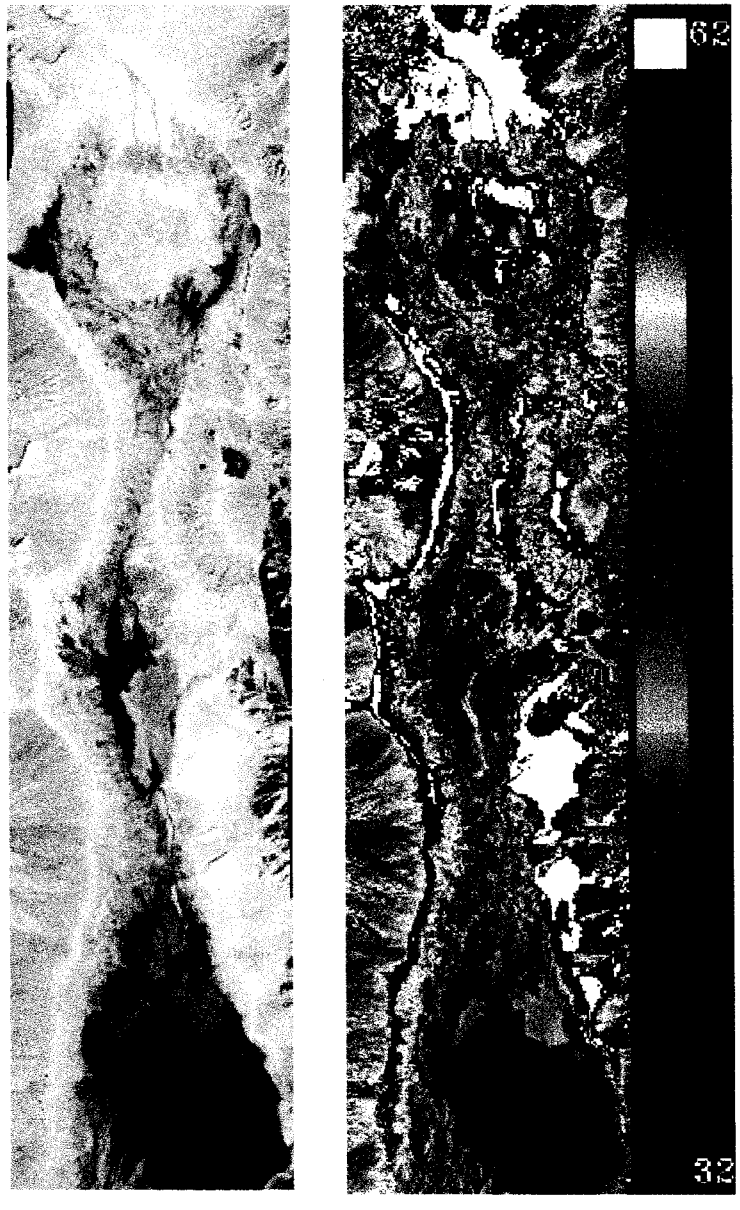
Death Valley



ASTER
JAPAN/USA

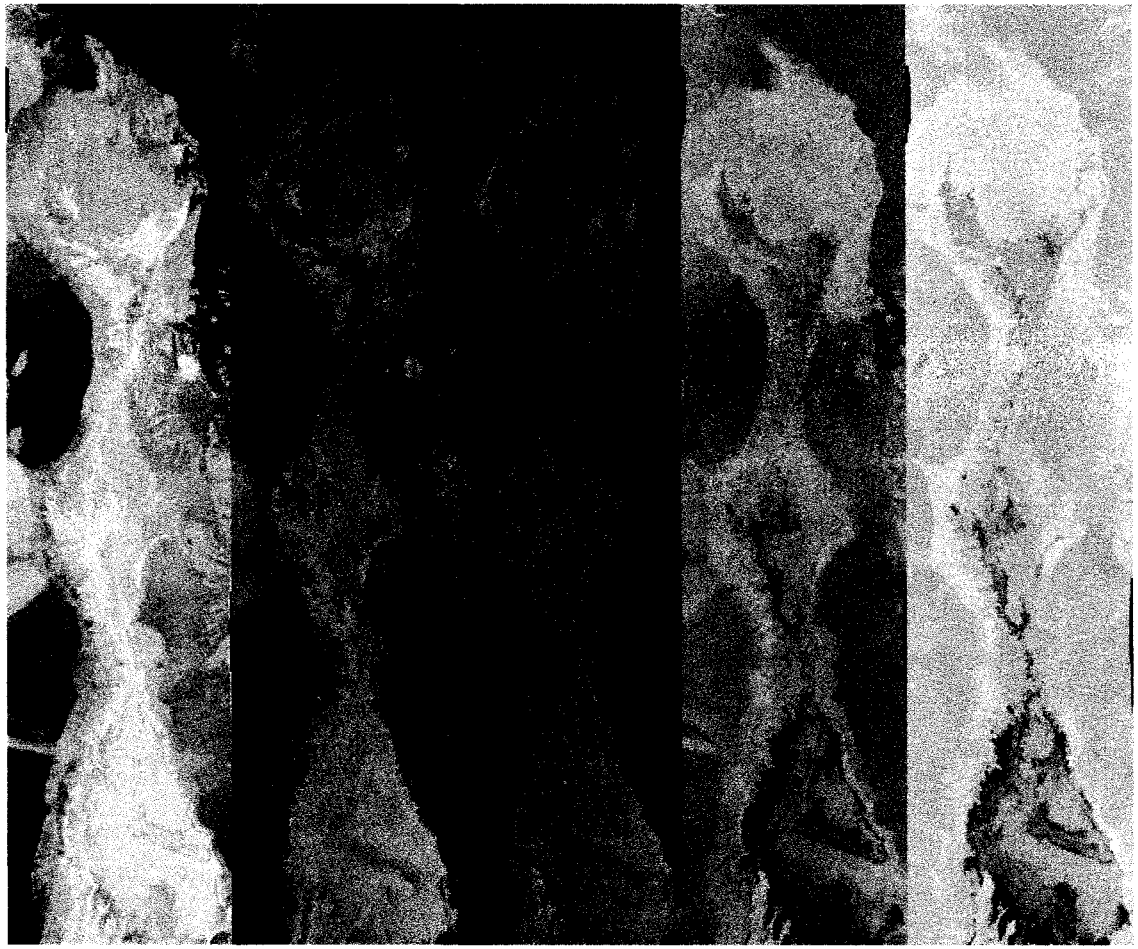
Death Valley

Temperature image from temp-emissivity separation



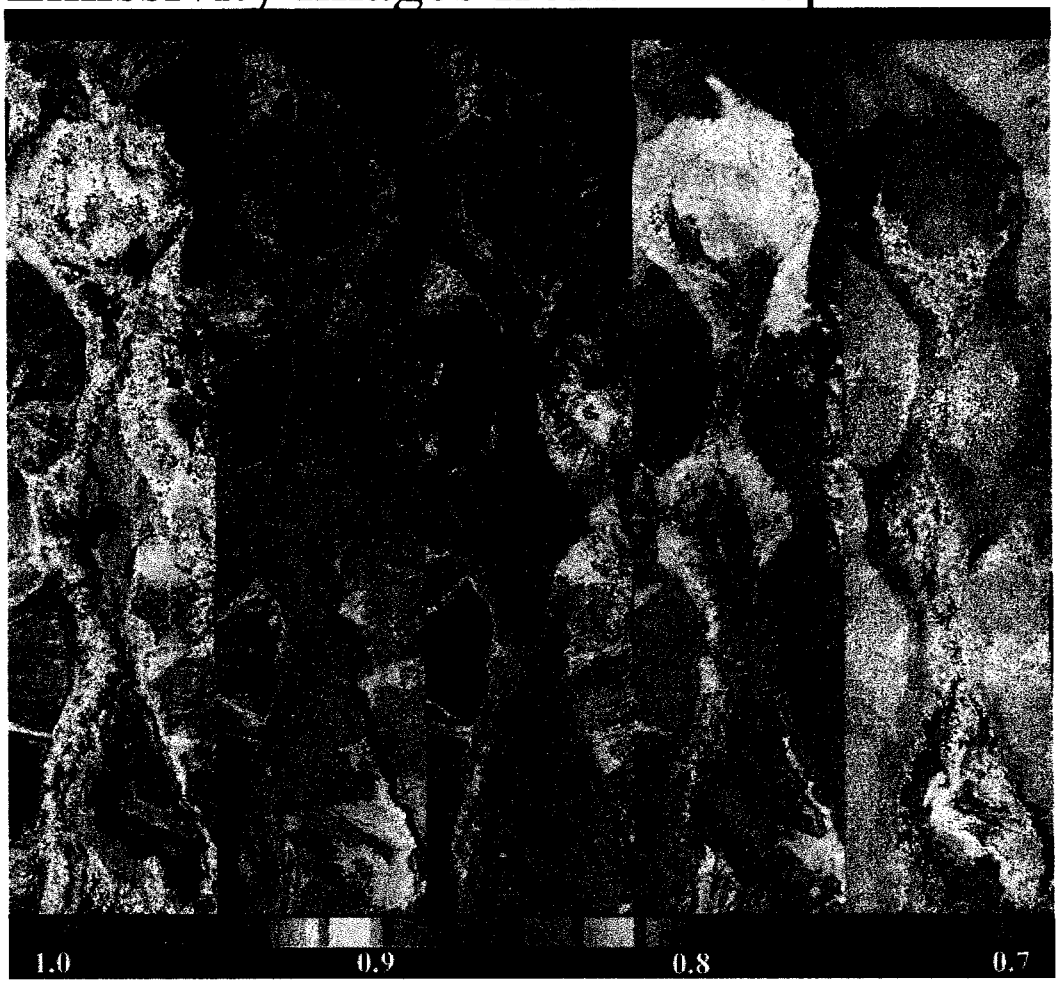
Death Valley

Emissivity images from T-E separation



Death Valley

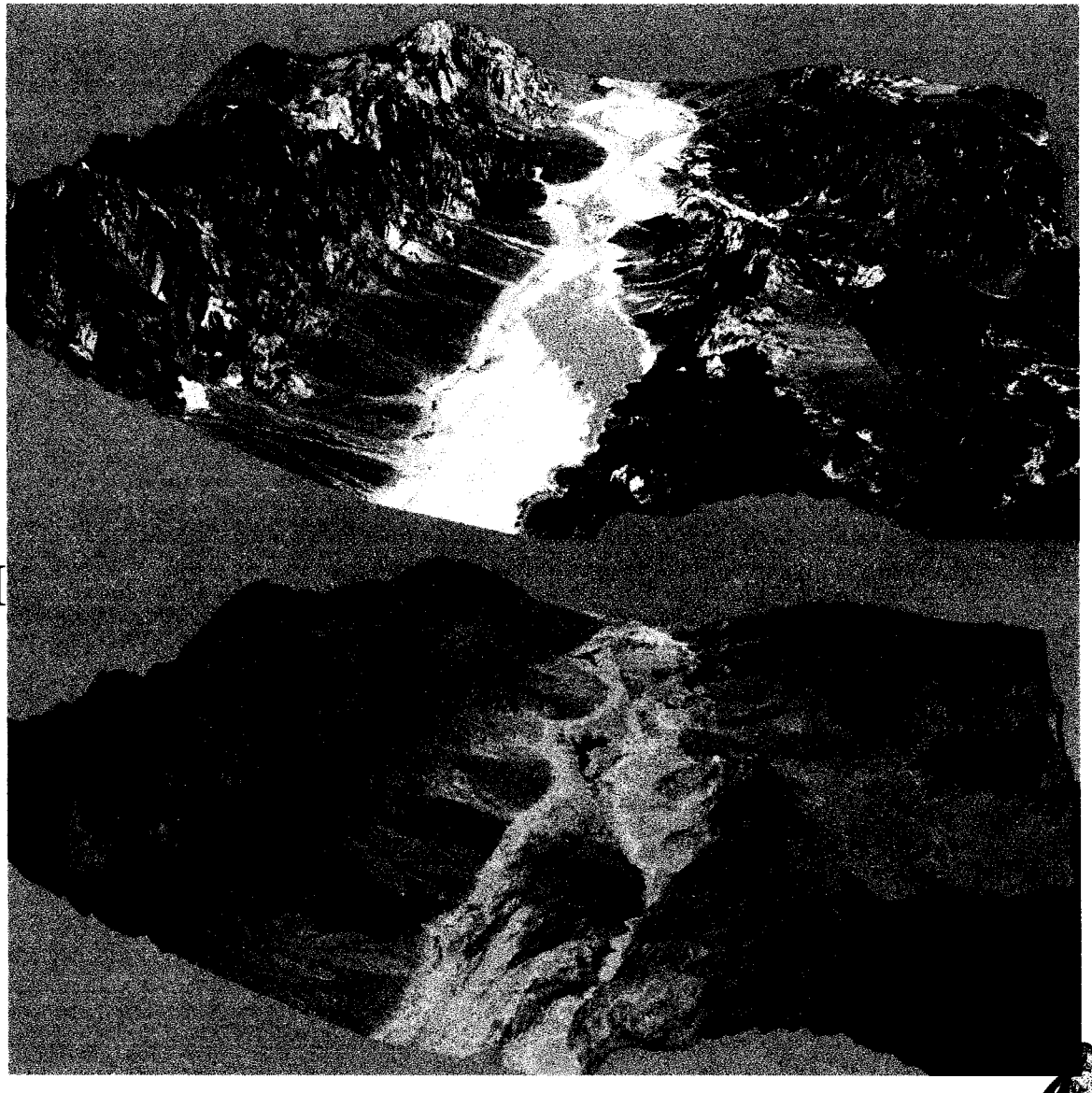
Emissivity images from T-E separation



Death Valley

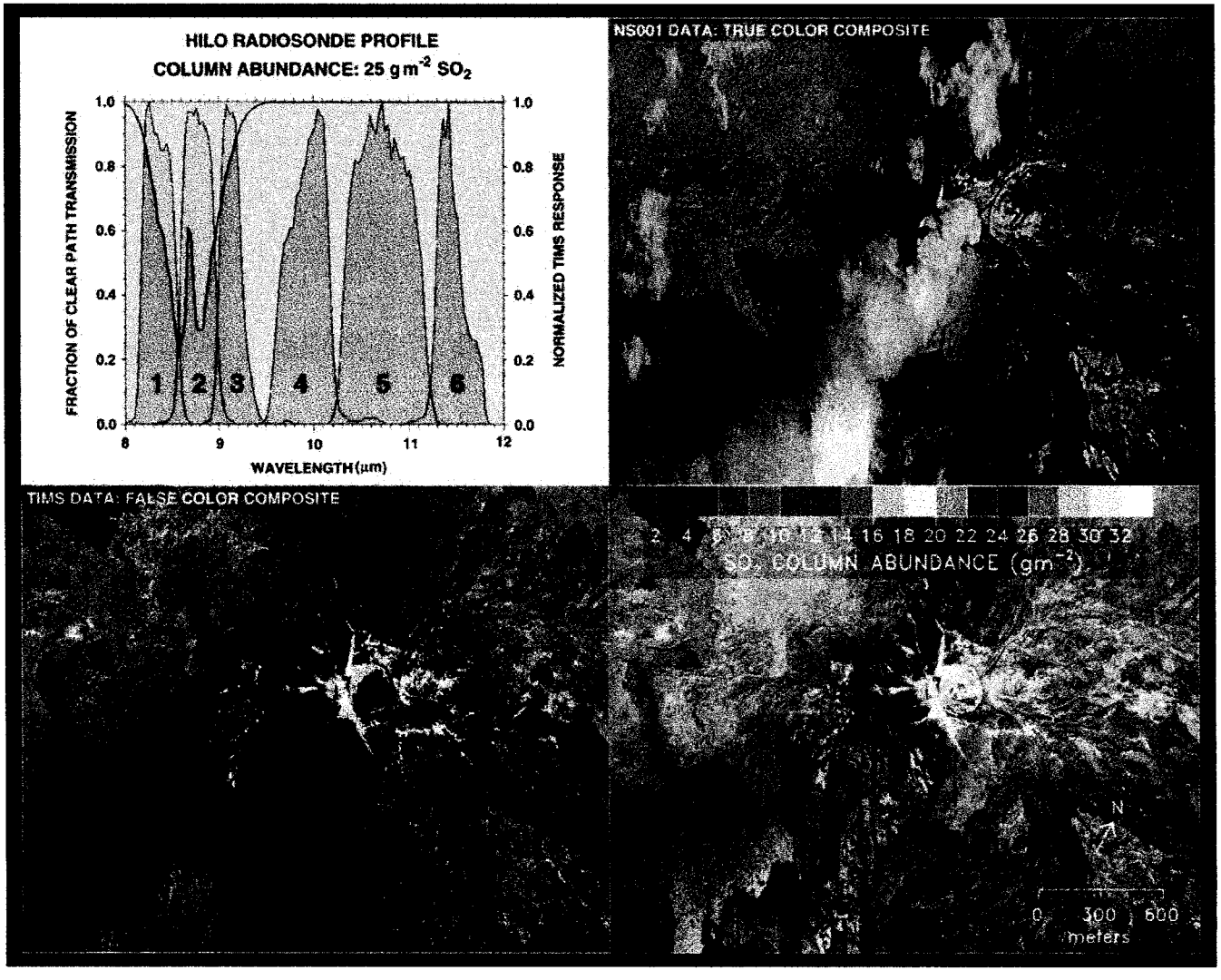
(top) VNIR-SWIR
+ ASTER DEM
(bottom) TIR +
ASTER DEM

60 x 60 km image



Popocatepetl Volcano, Mexico

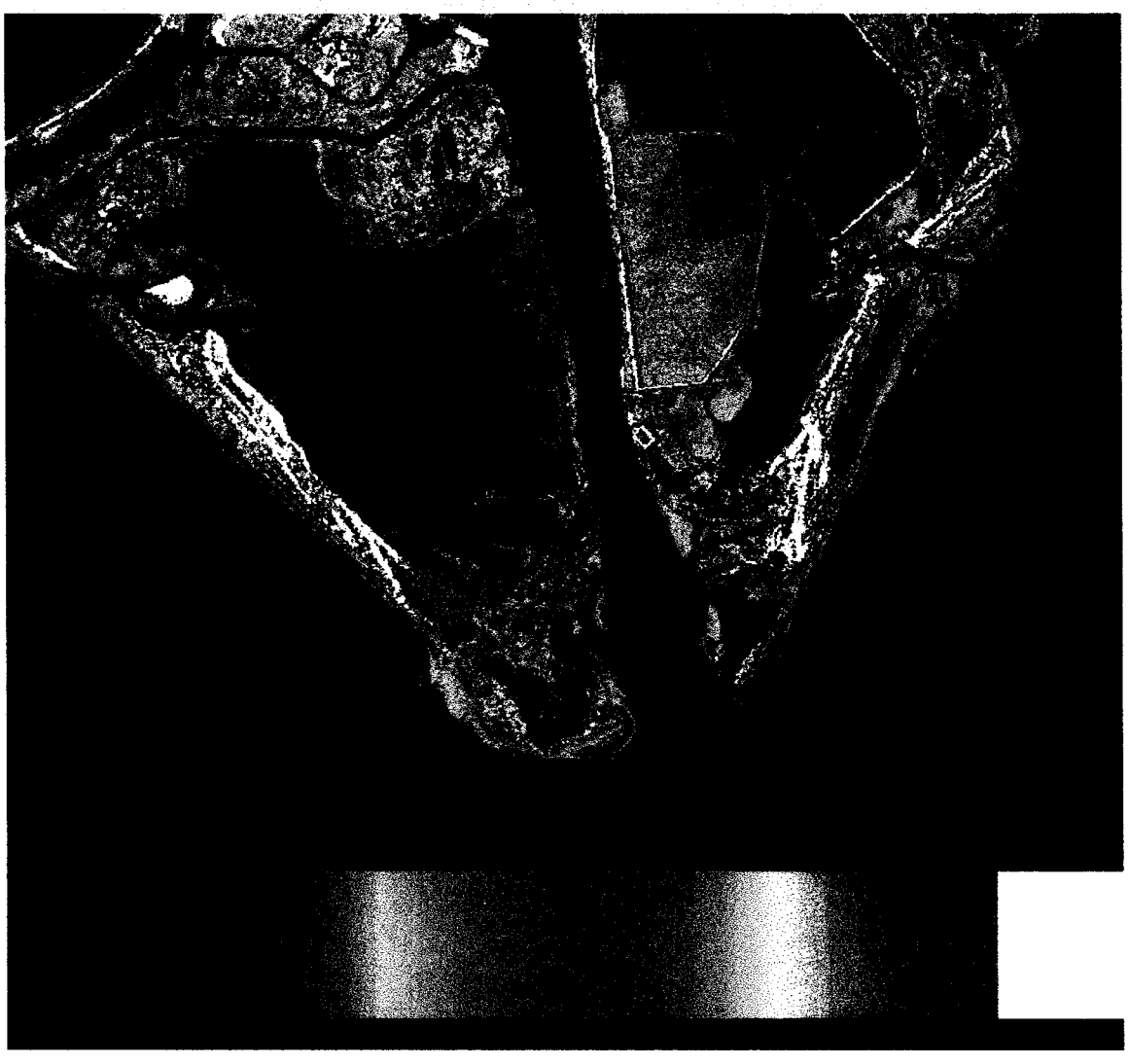
SO2 Recovery



Po River Delta

Po River Delta, Italy
ASTER 3-2-1 as RGB

Po River Delta, Italy
NDVI color sliced



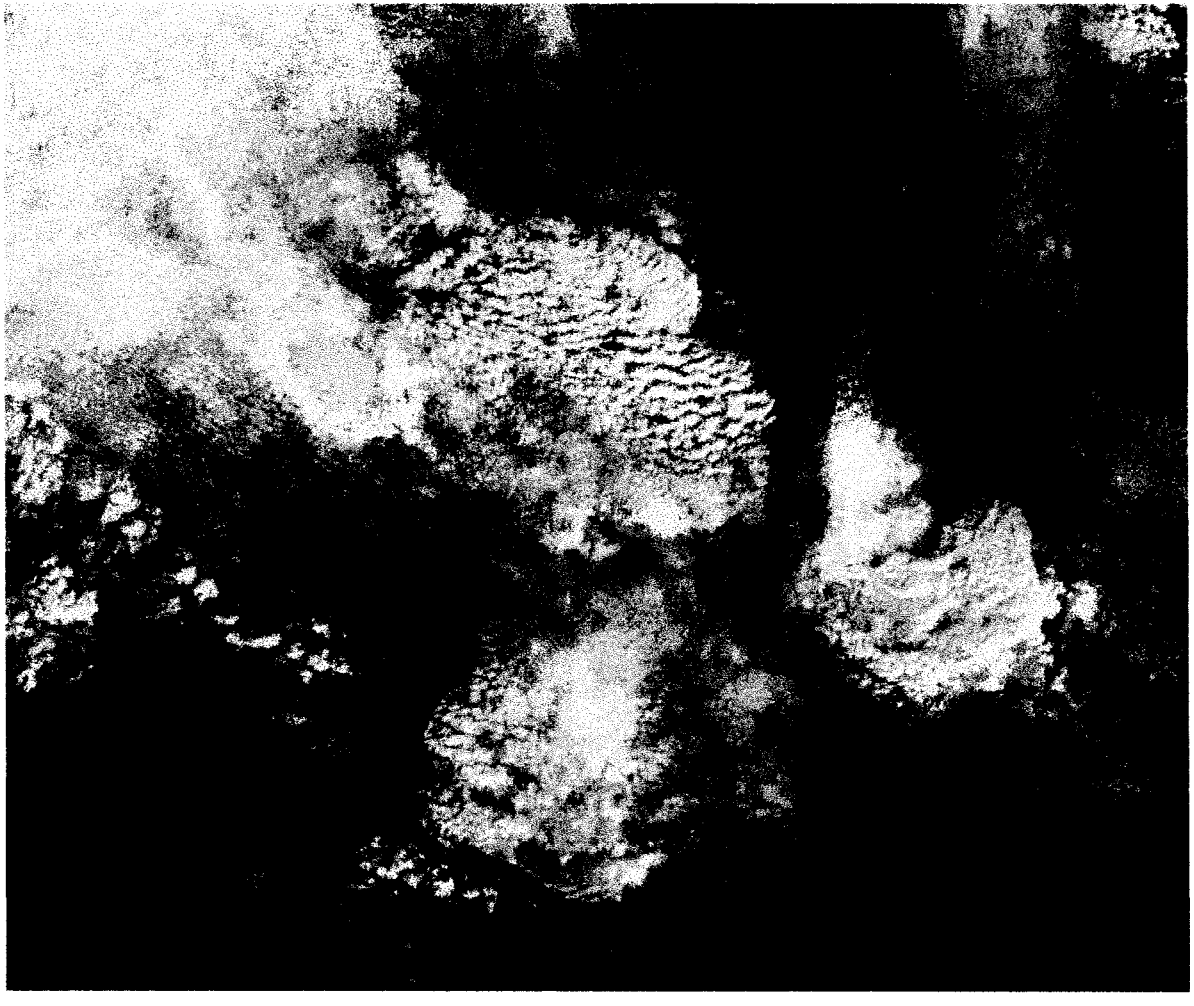
Po River Delta

Po River Delta, Italy
ASTER band 1: color sliced

Po River Delta

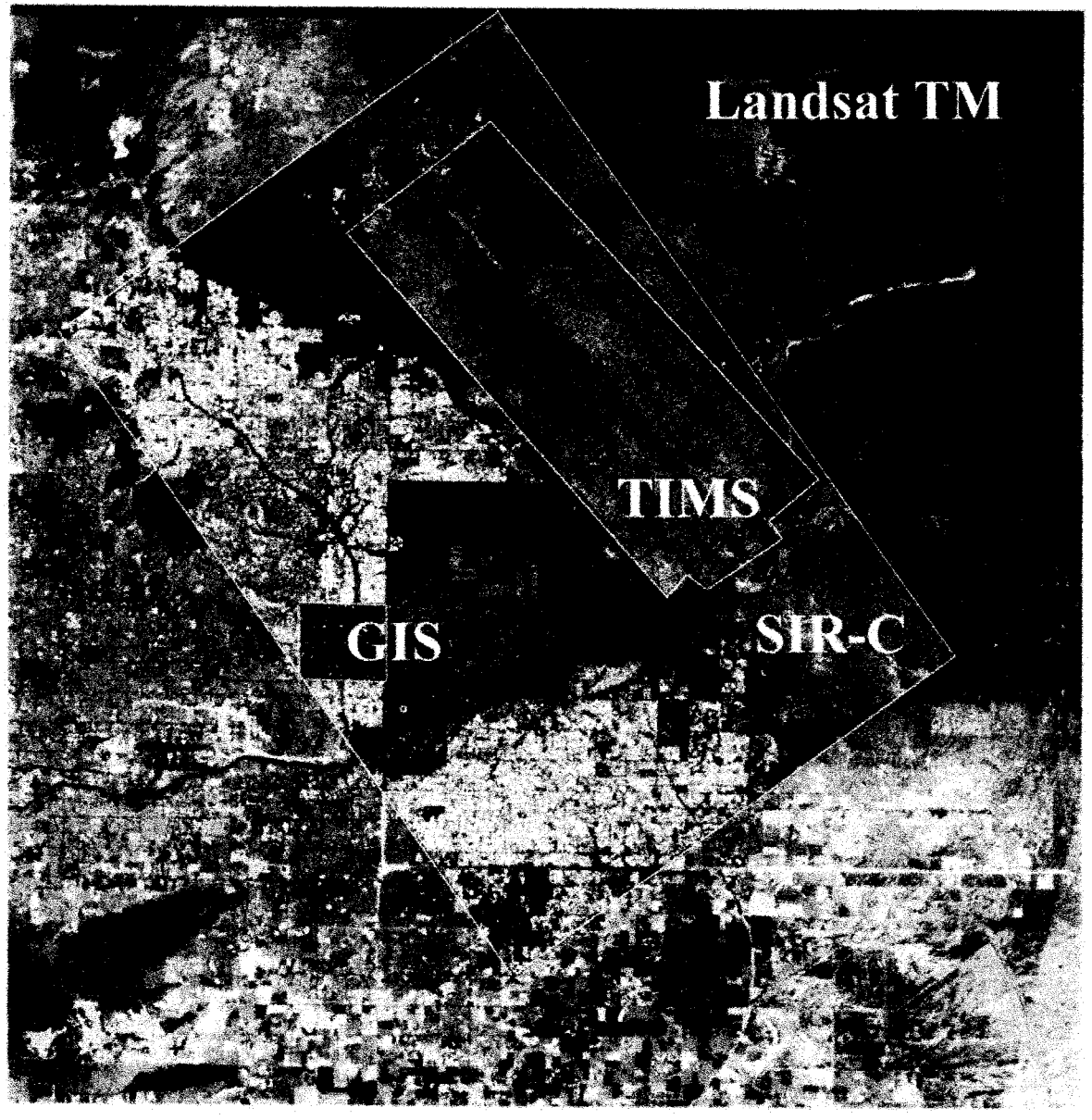
Po River Delta, Italy
ASTER ave T: color sliced

Cloud and Ice Separation Antarctica



Urban Land Use

Scottsdale, AZ



ASTER Web Site:
http://asterweb.jpl.nasa.gov

ASTER

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ASTER

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The primary objective for the ASTER mission is to:

- Obtain high spatial resolution global, regional and local targeted data in 14 channels from the visible through the thermal infrared wavelength regions.

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Questions? Comments? Contact: *Howard L Tan or Simon J Hook*
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ASTER